The Demographic Impact of AIDS in Africa: An Issue Brief

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EXECUTIVE SUMMARY

The rapidly rising rate of deaths due to acquired
immunodeficiency syndrome (AIDS) in Africa has caused an
unprecedented public health crisis across the continent. In
Africa, unlike in other regions, the predominant mode of
transmission of the human immunodeficiency virus (HIV), which
causes AIDS, has been heterosexual intercourse, and has been for
over a decade. This has led to a continent-wide epidemic of a
proportion unmatched in any other area of the world. Widespread
efforts to prevent transmission, by increasing the use of condoms
and other safe sexual practices and by improving the treatment of
sexually transmitted diseases, have met with only varying degrees
of success. Faced with this emergency, a major concern for
policy makers and development planners is the overall demographic
impact the disease will have on African countries. What will be
the long-term effects of AIDS on population growth rates and
other socioeconomic indicators in Africa?

Despite the many difficulties associated with accurately
calculating the long-term consequences of AIDS, some working
models have been designed to help individual countries make such
assessments. These calculations center around four crucial
issues: the effect that AIDS will have on population growth
rates in general; the impact of the disease on improvements made
thus far in child survival, such as declining infant mortality
rates; the extent to which the number of AIDS orphans will
continue to increase, and how this increase will influence
dependency ratios of African populations; and, the impact on

productivity levels of both urban and rural economies, given that the uniformly fatal disease commonly strikes young adults, who account for the largest segment of the workforce. These issues, along with descriptions of demographic impact projection models now available for use, are briefly examined in this paper, which is a synthesis of information on the demographic impact of AIDS in Africa. All documents referenced herein are available for those who wish further information.

BACKGROUND: FACTORS INFLUENCING DEMOGRAPHIC IMPACT

        Studies completed so far have identified several major trends within the African AIDS epidemic. It is concentrated primarily in eastern, central, and southern Africa, it is spread largely through heterosexual and perinatal transmission, and it most heavily affects adults of both sexes between the ages of 15 and 44.

        The many researchers working specifically to refine projections about the demographic implications of AIDS have discovered that within the African context several factors have significant influence: sexual contact patterns; the nature, distribution, and treatment of sexually transmitted diseases (STDs); geographic variations of HIV infection; and, migration rates.

        Sexual contact patterns are of importance on a number of levels. The probability of HIV transmission via sexual contact varies according to whether the infected individual is male or female, the absolute number and rate of change of sexual partners, the ages of the sexual partners, and the degree of heterogeneity in sexual activity within the population. Transmission has been shown to be more likely between an infected male and a susceptible female than the reverse. Consequently, the demographic impact of the disease will be greater, as any increase in mortality among females has a direct impact on the net fertility of the population (Anderson 1989, 270). There is still much debate about this issue, however (see "Population Growth Rates" section below).

        Of considerable importance among the factors influencing HIV transmission within a heterosexual population is the presence of genital ulcers and other types of STDs. Sexually transmitted diseases, found to be prevalent in the most severely affected regions in Africa, have been shown to increase the risk of transmission. In a study of seronegative prostitutes in Nairobi, 76 percent of the women with genital ulcer diseases tested HIV seropositive within two years. This compares with 44 percent of women in this study without genital ulcer disease (Piot 1987, 109).

        In Africa, as in other regions, the heterosexual spread of AIDS occurs most frequently in situations wherein relatively few women (usually prostitutes) have sexual contact with large numbers of men (Caldwell 1989, 217). Thus, work-related, migratory, and other forms of culturally based variations in sexual behavior determine to some extent the existing pattern of the AIDS epidemic in different regions of Africa.

        Regional variations in sexual behavior -- both between countries and between rural and urban areas -- are key to

explaining the geographic differences in AIDS prevalence in
Africa. Such differences can also be attributed in part to the
timing of the onset of the epidemic. Because eastern, southern,
and central Africa were the first areas where AIDS appeared, it
follows that these are the same regions where the disease first
reached epidemic proportions and where the disease has had its
greatest impact on adult mortality. Low levels of infection have
appeared in northern and western Africa, and in the absence of
effective programs for prevention and control, these regions may
also be plagued by an epidemic (Bongaarts and Way 1989, 8).

        Regional populations have been shown to experience higher
levels of HIV infection when simultaneously suffering from a high
prevalence of viruses and parasites, which may lead to increased
susceptibility through a chronic activation of the immune system.
High levels of HIV infection also are frequently found among
groups that do not practice male circumcision, the absence of
which has been strongly correlated with HIV prevalence (Bongaarts
and Way 1989, 10-11).

        Finally, migration is another likely explanation for
geographic variation. Among rural regions of Africa, migrant
laborers have been a source of transmission, as have males who
migrate from rural to urban areas without their families. The
HIV virus might also be spread by temporary migrants such as
soldiers and tradespeople (Lewis 1989, 25).

        Projecting the demographic impact of AIDS in Africa is a
difficult task. Nevertheless, estimates made to date merit
discussion. Although a comprehensive overview of all factors
included in these projections is beyond the scope of this paper,
the following four will be addressed: the effect on population
size and growth rates; the impact on recent improvements in
infant and child mortality; the increase in AIDS orphans and the
impact on the dependency ratio; and the impact on labor force
productivity. It must be remembered, however, that these
projections are only as reliable as the scarce epidemiological
data available from individual countries.

POPULATION GROWTH RATES

        Although there has been some conjecture that AIDS would
eliminate Africa's future population growth and possibly result
in a reduction in overall population levels, current estimates
suggest that AIDS and positive population growth rates will most
likely coexist (Torrey 1988, 44). One study that refutes this is
a 25-year projection of the epidemic based on the situation in
sub-Saharan Africa in 1990 and which estimates a regional
population reduction by as much as 50 million (Way and Stanecki
1991, 5). This model is currently being updated. Other studies
estimate population growth rates in eastern and central Africa
will most likely remain positive because of continuing high
fertility rates, which in urban areas are typically 5 or 6
percent per year (Bongaarts 1988, 35). According to recent World
Health Organization estimates, AIDS will slow Africa's overall
population growth rate of 3 percent by .5 percent -- resulting in
an average annual growth rate of 2.5 percent (World Health
Organization 1991, 355).

REVERSAL OF CHILD SURVIVAL GAINS

African nations have made great strides in the area of child survival over the past decade despite debilitating economic conditions. Access to immunization, oral rehydration, and family planning services has increased dramatically (Sullivan and Roskens, 1991, p. 13). One of the largest threats the AIDS epidemic holds for Africa is a decrease or even a complete reversal of the gains made in lowering mortality levels for infants and children under five years of age.   Since both men and women are being infected at an equal rate, large numbers of women of reproductive age are HIV positive. In the near term (over the next 10 to 25 years), the impact of AIDS on child survival is projected to be much more severe than the impact of the disease on population growth rates. Approximately one-third of all infants born to HIV-infected mothers will be HIV positive through what is known as vertical or perinatal transmission, subsequently increasing infant and child mortality. The surviving two-thirds of infants born to HIV-infected mothers will be orphaned before age 15. Mortality under age five is projected to increase by almost 50 percent in urban areas of Africa over the next 25 years as a result of the epidemic (Way and Stanecki 1991, 7).

Such estimates indicate that the success achieved to date with child survival interventions could easily be erased. In fact, as AIDS spreads in Africa, the recent gains made in ensuring child survival are likely to be not only erased, but increasingly reversed (Valleroy 1990, 669). Child and infant mortality rates, which were projected to decrease by 35 to 40 percent in the absence of AIDS, are now expected to remain the same or increase slightly because of AIDS (World Health Organization 1991, 355).

Child mortality levels adjusted to include the impact of the AIDS virus for selected African countries are shown in Figure 1. In each case, when adjusted for AIDS, mortality rates increase slightly or remain the same. The lack of visible differentials between the baseline and AIDS-adjusted mortality rates for some countries is a result of the difference in the number of births occurring in high and low prevalence areas. In most African countries, a large number of births occur in rural areas, where HIV prevalence remains low. This results in a negligible differential between the adjusted and non-adjusted rates. In some countries, on the other hand, the impact appears more extreme, as in Uganda (Figure 1a) and Zambia (Figure 1c). The differential in Uganda is caused in large part by the high prevalence of the virus in both rural and urban areas. (The infection has been present in Uganda longer than in most other African countries.) In Zambia, the differential is due to the fact that most births occur in high-prevalence urban areas, increasing the relative number of perinatally transmitted cases of HIV.

NEW ORPHANS AND DEPENDENCY RATIO IMPACT

Related to the issue of child survival is the number of children who will be orphaned as a result of losing their parents to AIDS. Unless partners are informed when their spouse is infected and ensure that they are protected by a condom during all subsequent sexual contact (very difficult to achieve), there is a risk of transmission between husband and wife. Thus, it may

be rare to see one parent survive when his or her spouse has been infected with HIV (Preble 1990, 678).

Such a situation results in children being residentially displaced. When housing is available with relatives or close friends, the children might end up in an extended family situation; if not, institutionalization or state adoption programs, where they exist, may be their only option (Eberstein 1988, 180).

During the 1990s, five to ten million children under the age of ten are expected to become AIDS orphans in Africa (Sullivan and Roskens 1991, 10), greatly increasing the burden on extended families. Many families in eastern and central Africa are experiencing the breakdown of extended family systems, as they are already stretched to their limits by the burden of AIDS-related caregiving (Hunter 1990, 683).

In spite of the increasing number of children who will become orphans as a result of AIDS, a dramatic shift in the dependency ratio is not expected for most countries. While the ratio is increased by the direct effects of mortality among sexually active adults, the reduction in birth rates combined with the death of reproductively mature adults tends to decrease the dependency ratio (Anderson 1988, 103). In other words, although the number of infants, children, and elderly without caregivers normally increases with increasing numbers of births, birth rates are now decreasing due to family planning and AIDS-related deaths in young adults. Without the presence of an epidemic, this decrease would lessen the dependency ratio. However, the number of adults who are capable of caring for these dependent groups is also on the decline because of the rise in AIDS-related deaths, balancing out any beneficial impact of the lower birth rates.

This information has recently been further refined to distinguish between the dependency ratio and the disease-related dependency ratio, the latter defined as the extra burden imposed by the care of AIDS patients. "The disease-related dependency ratio tends to increase with time as a consequence of the increasing burden of caring for AIDS cases as the epidemic unfolds" (Anderson 1989, 257).

Economic analysis suggests that the health care systems of sub-Saharan African countries will be able to provide only minimal care to AIDS cases in the future. Without a substantial increase in per capita health expenditures, even treatment costs as low as $100 per patient will not be sustainable (Rowley 1990, 54). One analysis of the cost-effectiveness of AIDS prevention programs presents a model that is intended "to guide the setting of priorities for the use of finite resources, with the objective of achieving the maximum reduction in AIDS-related mortality and morbidity" (Weinstein 1989, 473).

The impact of AIDS on the dependency ratio within a given population will be determined in large part by the demographic and epidemiological patterns present in that particular community, such as the fertility rate, the existing dependency ratio and the presence of high risk groups (Anderson 1988, 233).

HUMAN RESOURCES: THE EFFECT ON PRODUCTIVITY LEVELS

Because those stricken with AIDS are usually from the most productive age group in society, there is much concern about how the epidemic will affect production levels and economic development. At the household level, the death or illness of the main provider often leads to abject poverty for the family. At the national level, economic productivity will also decline. "Primary industry will be affected through loss of productivity from the illness, early retirement, and death of expensively trained skilled and unskilled employees" (Fleming 1990, 194-195).

One study assessing the effect of AIDS on copper mining in Zambia illustrate the potential impact of the disease on industry throughout the developing world. Because copper mining in Zambia is labor intensive, any reduction in the efficiency of the labor force that results from ill health and death will affect the industry significantly. Other implications include rising costs placed on industry to provide extra services, such as early retirement benefits or family support that in turn would reduce overall profits (Nkowane 1988, 158). Industries, particularly labor-intensive industries, will most likely be forced to set aside a higher percentage of its profits to compensate for this mortality impact.

A similar assessment has been made of the impact that AIDS will have on food production. Africa is the only region of the world where food production has been declining over the last 20 years, a situation further threatened by AIDS. "In order to ensure the continuation of food production, any strategy for coping with AIDS must include measures to support local farming systems if and when population declines" (Abel 1988, 146). The extent to which rural production systems are affected by increased mortality will be influenced by the extent to which farming systems are exposed to spatial and/or cultural transmission patterns of the disease (such as urban-rural migration) (Abel 1988, 148). AIDS-adjusted adult mortality levels are shown in Figure 2.

INTERVENTIONS: WHAT WORKS

In view of the devastating effects of the AIDS crisis, it is crucial for African nations to implement those AIDS prevention programs that have proven most successful. Since 1987, the World Health Organization's Global Programme on AIDS (WHO/GPA), has assisted more than 100 countries in the developing world to establish National AIDS Control Programs. These programs promote prevention activities such as education, blood screening, and research. The U.S. Agency for International Development (USAID) is the largest financial supporter of WHO/GPA, and, in addition, funds its own bilateral assistance program for AIDS prevention. Programs such as the AIDS Technical Support Project of the Research and Development Bureau, which have information, education, communication, and research components, aim to increase the use of condoms, reduce the number of partners and other high-risk behaviors, and decrease the prevalence of STDs (USAID 1991, 1).

The major lesson learned through interventions carried out to date is that the spread of HIV and AIDS is slowed most effectively by focusing on programs that change sexual behavior

and control the spread of other sexually transmitted diseases.
Examples of activities currently targeting behavior change are
condom sales and promotion, education about the benefits of
partner reduction, and social marketing campaigns promoting AIDS
awareness. Yet despite such efforts to control the disease, AIDS
continues to outpace attempts to contain it. USAID has
recommended that more support be given to improving the
prevention and control of AIDS and other sexually transmitted
diseases (USAID 1991, 23; Sullivan and Roskens 1991, 26).

MODELS

        In the section that follows, several models for projecting
the demographic impact of AIDS are described. Readers should
refer to the cited documents for technical details on the
structure of these models.

Interagency Working Group

        The U.S. State Department's Interagency Working Group (IWG)
model for the spread of HIV uses data derived from surveys,
surveillance, and special studies on AIDS in developing
countries. With support from USAID, the Center for International
Research at the Bureau of the Census maintains a database with
results from these surveys. Once the country-specific data are
evaluated by trained epidemiologists and demographers, the data
are incorporated into the IWGAIDS model. The model requires
additional age- and sex-specific data on behavioral risk factors
in order to analyze the spread of HIV through heterosexual
partnerships, blood transfusions, perinatal transmission, and
intravenous drug use. The computer-based IWG model incorporates
data on factors known to affect the epidemic as well as estimates
of data on factors that are still speculative. This model is
"designed to provide...insights into specific demographic and
epidemiological questions about the epidemic," including the
effect on dependency ratios, infant and child mortality, and
population growth rates (Stanley 1989(a), 2). It can also be
used to simulate implementing individual or combined
interventions to reduce HIV transmission. Such simulation
efforts are underway to assist WHO/GPA to set reasonable and
effective target levels for condom use, partner reduction, and
STD treatment.

AIM and DEMPROJ

        The Demographic Projection Model (DEMPROJ) and the
presentation graphics software known as the AIDS Impact Model
(AIM), like IWGAIDS, are computer-based and can be used on a
personal computer, but are less complex. Both DEMPROJ and AIM
were created by the Future's Group and are the results of A.I.D.-
funded projects. A full-featured population projection program,
DEMPROJ features a special section on AIDS that incorporates
assumptions about the future course of HIV infection into the
demographic projections. "DEMPROJ does not project the spread of
the infection but does allow the user to examine the demographic
consequences of different assumptions about the incidence of new
HIV infections" (Stover 1990(b), 3).

        Developed by the Futures Group under a subcontract to the

Family Health International AIDSTECH project, AIM does not
compute the projections itself, but uses the output of the IWG
model or DEMPROJ. AIM displays the IWG or DEMPROJ results in
graphic form through the use of a user-friendly menu system for
presentations and workshops. AIM also "extends the
epidemiological calculations to examine the socioeconomic impacts
of AIDS, which may be different for each application" (Stover,
1990(a), 2).

Bongaarts Model

        A mathematical model for forecasting the spread of HIV and
the ensuing demographic consequences has been developed by John
Bongaarts of the Population Council. The objectives of this
model are similar to the IWG in that they seek to project annual
incidence and prevalence of HIV infection and AIDS, AIDS deaths,
the impact of AIDS on such variables as population size and
growth rate, age and sex structure, birth and death rates, life
expectancy, and mortality rates within different groups.
Interventions such as blood screening may also be accounted for
in this model (Bongaarts, 1988, p. 2). However, studies
evaluating the Bongaarts model have determined that the numerical
code Bongaarts developed to predict the spread of HIV infection
and progression to AIDS is not acceptable (Stanley 1989(b), 2).
Results are described as unpredictable because the code is based
on flawed assumptions, contains programming errors, and the
population structures used are unrealistic and inflexible. For
example, the code assumes no routes for transmitting infection
below the age of 15. For cultures not meeting this population
structure, the code is not applicable (Stanley 1989(b), 6).
Based on this information, the AIDS Division of A.I.D.'s Office
of Health of the Research and Development Bureau does not
recommend use of the Bongaarts model for projecting AIDS cases
and impact.

Anderson, May, and McClean Model

        Roy Anderson and colleagues have developed a mathematical
model that describes the spread of HIV within heterosexual
communities and the demographic impact of AIDS in sub-Saharan
Africa. This model was recently revised to emphasize dependency
ratio, the significance of different sexual contact patterns
between different age groups of both sexes, and the future impact
of control measures such as education and condom use (Anderson
1988; Anderson 1989).

SUMMARY

        Although no definitive projections have been developed as
yet, most studies concur that AIDS will produce a decline in
population growth rates in Africa, but not enough to result in
these rates becoming negative in the near future, especially if
current preventive efforts are successful. There is a great
danger that the accomplishments made in child survival on the
continent will be either erased or reversed, and that the number
of orphans resulting from the death of infected parents will
contribute to this reversal. The orphan issue may also threaten
the well-being of the extended family, which may not be able to
endure the added pressure of caring for more children. The
studies mentioned in this paper conclude that there will be

virtually no impact on the overall dependency ratio in Africa, but that the disease-related dependency ratio is likely to increase. The impact on labor productivity, both in industry and agriculture, could be severe, but will vary greatly depending on the specific epidemiological and demographic patterns within different areas. Finally, the interventions that will most likely have the greatest impact are those targeting behavior change, particularly in reduction in the number of sexual partners and in the use of condoms.

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